RHYOLITE QUARRY AND QUARRY-RELATED SITES IN MARYLAND AND PENNSYLVANIA

R. Michael Stewart

Abstract

Metamorphosed rhyolites in Maryland and Pennsylvania can be found as massive outcroppings, extensive boulder fields, talus, and cobbles in streambeds and terrace deposits. This paper examines the variety of prehistoric quarry and quarry-related sites associated with rhyolite deposits. The functioning of these sites within appropriate settlement systems is discussed. Changes in the way that rhyolite is exploited through time are related to both environmental and cultural factors.

Introduction

In 1892, the noted archeologist, William Henry Holmes, acutely interested in prehistoric quarries, began a search for rhyolite workshops in the Blue Ridge Province of Maryland where the rock occurs. Holmes's search was spurred by the frequent occurrence of rhyolite artifacts far from presumed sources of the material (Holmes 1897). He eventually located rhyolite quarries and workshops, but in Pennsylvania, not in Maryland. Henry Deisher later reported on the workshops initially located by Holmes in a 1933 issue of the *Pennsylvania Archaeologist.* John Witthoft, in the early 1950s, examined these and additional localities with the cooperation of local amateur archeologists. One offshoot of this work was Witthoft's initial definition of Broadspear traditions of the Late Archaic period (Witthoft 1953).

This paper summarizes more recent investigations of prehistoric rhyolite quarries and quarry-related sites (cf. Stewart 1980a,b; 1983; 1984a,b). Of particular interest is how the use of these localities has changed over time and what this implies about other aspects of prehistoric life, particularly settlement patterns and the relationships between the various groups that sought the material. Although I draw on information from Pennsylvania sites, the core of the following discussion is based upon investigations at a variety of localities in Maryland that went undiscovered by earlier researchers.

Background

Figure 1 shows the location of the study area and the general extent of rhyolite formations in Maryland and Pennsylvania. These formations are found in the Blue Ridge Province in Maryland and Pennsylvania (cf. Stewart 1984a). An isolated source of rhyolite occurs in the Pennsylvania Piedmont along the Susquehanna River just north of Wrightsville (Socolow 1980). To the south, additional sources of rhyolite are found in extreme southwestern Virginia near Mount Rogers (cf. Haynes 1987) approximately 300 miles from the Maryland and Pennsylvania formations. Approximately 300 miles to the north, a variety of rhyolites can be found scattered throughout New England (cf. Gramly 1980; Johnson et al. 1984).

The rhyolites of Maryland and Pennsylvania are Precambrian lavas, later altered or metamorphosed by the intense heat and pressure associated with the creation of the Appalachian Mountains. Ten distinct types of rhyolite, or metarhyolite as it should be technically referred to (cf. Stewart 1984a), have been defined in the formations that span approximately 30 linear miles of the Blue Ridge in Maryland and Pennsylvania. Rhyolite can be found as outcrops of bedrock, boulder fields which are often associated with outcrops but also occur frequently without them, and cobbles in streambeds and terrace deposits. Most substantial stream deposits of rhyolite are within 20 miles of bedrock but cobbles have been found on the Maryland Coastal Plain 120 miles away. Boulder fields represent the most widely distributed, concentrated source of the material. Although they can be massive, continuous bedrock exposures are usually less than 100 feet long. Extensive localities like the Carbaugh Run National Register District in Pennsylvania (Beckerman 1981) represent a nearly continuous series of individual bedrock exposures.

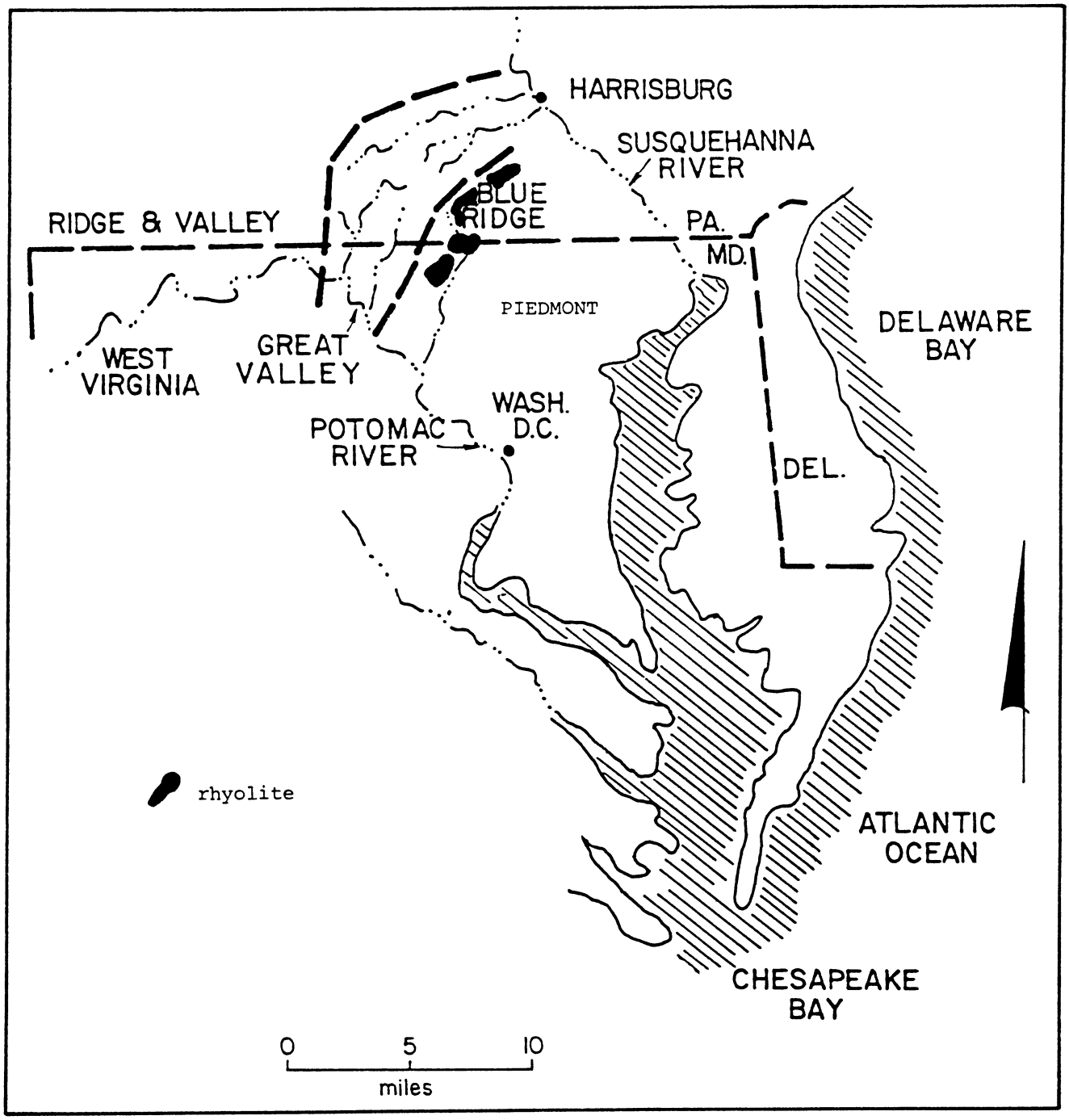

FIGURE 1. Regional Position of Study Area.

The metamorphism associated with mountain building in the area had variable effects on rhyolite formations. Where metamorphic pressures paralleled rhyolite bedding or cleavage planes, a superior rhyolite, in terms of knapping qualities, resulted. As metamorphic pressures were applied at more perpendicular angles to existing bedding planes, a blocky rhyolite, prone to step fracturing, was created. Because of these factors, the knapping quality of rhyolite can vary dramatically from source to source over relatively short distances. Variation in knapping quality can also be quite marked at a single source. Stewart (1984a) summarizes the earlier geologic work of Fauth (1968, 1977, 1978), Freedman (1967), and others regarding rhyolite and its significance for archeological studies.

The Blue Ridge Province is a mountainous district separating the Great Valley on the west from the Piedmont to the east. Topographic relief is highly variable with elevations ranging from 500 to 2000 feet above sea level. Elevations below 1000 feet are generally associated with lower sections of intermontane valleys. The province is drained by a large number of third and lower order streams that are divided between the Potomac and Susquehanna River basins. They geology of the province consists of Precambrian and Cambrian metabasalt, quartzite, shale, phyllite, schist, and granitic gneiss in addition to rhyolite. Quartz occurs sporadically within a number of these formations. Most of the rhyolite formations are associated with the Catoctin Metabasalt.

A distinction can be made between the northern and southern Blue Ridge environments where rhyolites are found. In the northern half of the Blue Ridge, rhyolite outcrops generally occur above 1000 feet in elevation and are most commonly found between 1300 and 1600 feet above sea level. This area includes mountain tops, both small and moderately broad intermontane valleys, and the easternmost highlands of the province. In contrast, southern sections of the Blue Ridge are generally lower in elevation and encompass much broader and low relief stream valleys than northern sections.

Site distribution data summarized in this paper have been collected since 1978 as a result of several regional surveys including: the Great Valley in Maryland (Stewart 1980a); the Maryland Blue Ridge Province (Stewart 1983); and the Maryland Piedmont (Peck 1979; Kavanagh 1982). This information has been supplemented by the results of various cultural resource management studies for Maryland and Pennsylvania areas, extensive interviews with artifact collectors and amateur archeologists, and examination of public and privately held artifact collections. Data collection continues and substantial artifact collections from quarry and quarry-related sites in Maryland and Pennsylvania remain to be analyzed.

Site Typology: Quarries and Related Localities

Quarry and production related phenomena can be organized into four basic site types based on site location and the nature of related artifact assemblages: quarries; quarry-related workshops; non-quarry-related workshops; and processing stations. This typology is established with the realization that variations in site locations and artifact assemblages occur. However, the proposed site types adequately summarize the majority of the variation observed thus far in Maryland and Pennsylvania studies and are a useful device for structuring additional research and the formulation of hypotheses for testing. Pennsylvania quarry and quarry-related sites are included in this typology. This typology parallels the scheme proposed by Gardner (cf. 1974, 1977) for Paleoindian quarry and quarry-related sites.

Rhyolite quarries are locations where material was procured and little reduction took place, other than that necessary to remove desired masses of rock from parent material and to evaluate the knapping quality of various pieces. Rhyolite sources both near and well removed from surface water were used as quarries. As might be expected, locations that combine a high quality rhyolite source with an otherwise attractive setting, including surface water, are the sites that appear to have been most frequently reused. In terms of environmental quality, it is my impression that there is a threshold that is reached whereupon quarry activities are always associated with workshop activities. This environmental threshold has yet to be quantified.

Aboriginally excavated pits can be associated with rhyolite quarries. The pits are conical in shape, range from 6 to 12 feet in diameter, and are up to 8 feet deep. These observations are based on the current morphology of the pits. Archeological excavations of these features might reveal that they originally had greater dimensions. A mounded berm of soil and rock fragments generally encircles the pits. The pits resemble the aboriginal quarry holes described by Hatch and Miller (1985) for the jasper quarries at Vera Cruz, Pennsylvania. In

the midwest, the use of quarry pits is part of an overall intensification in lithic production that occurs late in time (Vehik 1985:85).

At Maryland localities, pit features only occur at rhyolite quarry sites where a bedrock outcrop is involved. The pits are usually oriented around the face of the outcrops. In Pennsylvania, the pits are found on rhyolite quarry and quarry-related workshop sites. The presumed purpose of the pits is to get at relatively unweathered spalls and chunks of material buried around outcrops. Rhyolite appears to weather rapidly with dramatic changes in original color, patina, and presumably knapping quality taking place over a span of approximately 145 years (Stewart 1984a:9-12). The burial material retards, but does not halt, the weathering process. In Maryland, the pit features have only been observed at quarry sites where the quality of rhyolite exposed in bedrock outcroppings is poor. This is not the case in Pennsylvania where the pits occur in conjunction with rhyolite outcrops and boulder fields where material can be found with adequate to excellent knapping characteristics. The Carbaugh Run locality is an example of the latter situation. Carbaugh Run is also more accurately characterized as a combined quarry and workshop (see discussions below).

The outcrops at quarry sites show no evidence of having been directly worked. There are no scorched sections to suggest that fire and water were used to force the rock to spall. There are no battered outcrop faces to suggest that large hammers, sledges, or wedges were employed to detach rock, and no such tools have been found in related archeological deposits. There was probably no need to expend this kind of effort to extract material since spalls of rhyolite and boulder fields are usually associated with outcrops. However, rhyolite does weather to a state in which flake scars and other traces of damage become obscured and eventually are invisible to the naked eye. Worked outcrop faces could have simply weathered so thoroughly that evidence of aboriginal quarrying is presently unrecognizable.

As noted above, artifact assemblages from strict quarry sites show little diversity and generally include chunks and slabs of material that have been flaked in a cursory fashion. It is difficult at times to distinguish artifacts of this type from spalls that have been naturally detached from bedrock. Even in situations where quarry pits have been excavated and the debris from the pits can be isolated, it is still difficult to confidently separate intentionally created debris from ecofacts. In most cases, however, the occurrence of the odd discarded tool (part of whatever tool kits were brought in to the quarry) or debitage representing the resharpening or maintenance of finished implements, reaffirms the presence of prehistoric folk in search of raw material. The occurrence of these incidental artifacts further suggests that trips to quarries were combined with hunting and gathering activities.

Combined quarry and workshop sites are locations where rhyolite was procured and taken through early and middle stages (Callahan 1979) of bifacial and core reduction. Quarry workshops are associated with outcrops, boulder fields, and very rarely, stream deposits of rhyolite. Most quarry workshops are near surface water and in settings that would otherwise be typical of a camp or non-quarry-related site. Most of these sites appear to have been intensively reused through time. Without the benefit of detailed excavations, we can only assume that the quarry and workshop activities were combined during individual episodes of site use. It is possible that the localities served alternately as quarries or workshops depending on the particular needs of the group visiting the site. The extensive artifact deposits resulting from repeated use of the sites may have effectively masked variable use if it did occur.

Large bifaces (up to six inches long and three inches wide) with variable width/thickness ratios are typically found along with tremendous amounts of debitage of appropriate size ranges. Many humped, or turtlebacked bifaces, generally thought to be manufacturing rejects that could not be properly thinned, may be in fact cores in various stages of production. There is a lack of prepared and heavily damaged platforms on the worked edges of these artifacts which is not what would be expected if they were indeed aborted bifaces. The definition of a core industry at quarry workshops has been largely ignored since the evidence of bifacial reduction is so pervasive and overwhelming.

Failed late stage bifaces and finished tools appear at quarry workshops but in small quantities relative to the frequency of early stage forms. Many late stage tools were probably in the toolkits of the Indians when they arrived at the quarry workshop and were simply discarded on-site as they broke during use, or as existing toolkits were replenished with newly fashioned implements.

Workshops located away from the rhyolite source, but still within the Blue Ridge, can also be noted. Their separation from the actual quarry location is the major feature that distinguishes them from quarry-related workshops. The non-quarry-related workshops are found near surface water in settings that would be nor-

mally exploited by hunter gatherers in the region. Artifact assemblages are comparable to those at the quarry-related sites. The size of the non-quarry-related workshops is highly variable. Many are large and probably frequently reused, like typical quarry-related workshops. There are a number of them, however, that are quite small, and probably represent a single episode of use by an individual or small group. The locations of the smaller workshops are difficult to predict since they essentially represent a hunting station or transient camp site type (Stewart 1980a:104) with the addition of workshop activities.

Of all production related sites, rhyolite processing stations are found at the greatest distances from sources of the material. This site type occurs in the extreme eastern and western foothills of the Maryland and Pennsylvania Blue Ridge and out into the Piedmont or Great Valley within two miles of the mountain's edge. Processing stations are also known from the southern end of the Maryland Blue Ridge where the provinces opens up into the broad Middletown Valley (Stewart 1983:44, Figure 5). Rhyolite processing stations are associated with streams and gaps leading out from interior portions of the Blue Ridge where rhyolite sources are located. Each processing station thus far identified shows signs of repeated use through time.

Processing stations are further characterized by the occurrence of broken and rejected late stage bifaces, fragments and rejects of projectiles and other bifacial tools, cores, and flake waste generally less than two inches in greatest dimension (Stewart 1983:57-58). Early and middle stage bifaces occur but in extremely low frequencies; these are one of the major types of artifacts being reduced on-site and their poor representation as whole specimens or recognizable fragments is thus not surprising. Moderate numbers of broken or wasted tools and debitage indicative of tool maintenance, typical of a general campsite assemblage, are also found. Rhyolite processing stations are basically staging areas. Groups returning from forays in the Blue Ridge camped at processing stations for extended periods, finishing the manufacturing processes begun in the mountains.

Processing stations also served as expedient sources of rhyolite for groups unwilling or unable to venture into the Blue Ridge. The manufacturing debris at rhyolite processing stations was undoubtedly picked over by later occupants for discarded tools that could be refurbished and flakes and chunks of sufficient size that could be used to manufacture new tools. The unique way in which rhyolite weathers has enabled tools once discarded, then retrieved years later and refurbished, to be identified (Stewart 1984a:11).

Diachronic Perspective and Discussion

In the regions surrounding the Maryland and Pennsylvania Blue Ridge, rhyolite was employed for the manufacturing of tools throughout much of prehistory (cf. Stewart 1980a,b, 1984b; Kavanagh 1982; Kent 1970). Its use begins during the Early Archaic period. It accounts, on the average, for over half of all diagnostic Middle Archaic projectile points in the Piedmont and Great Valley. During the Late Archaic and Early Woodland periods, rhyolite is employed to the near exclusion of other materials. The use of rhyolite begins to decline late in the Middle Woodland period, and it accounts for approximately half of the diagnostic projectiles in Late Woodland assemblages.

These utilization trends generally coincide with changes in settlement patterns and the role that the exploitation of upland and mountain environments plays in these systems through time. In turn, changes in the way in which upland and mountain settings are used reflects the quality of changing prehistoric environments (see below and Stewart 1980a,b, 1983; Carbone 1976). The use of rhyolite increases through time as populations grow, exploitative territories decrease in size, and settlement movements and site locations become very stereotyped or regularized. Rhyolite is a locally abundant lithic resource that receives greater attention as material options open to local groups decrease through time. Throughout the eastern United States, locally abundant sources of relatively tough lithic materials (Callahan 1979:Table 3) experience very similar trends in use. The use of quartzite on the Coastal Plain of Maryland and Virginia, and the exploitation of argillite in the Delaware Valley are comparable examples.

The decreased mobilty of Late Woodland populations, their heavier reliance on a core technology, and a settlement and subsistence system grounded in farming-oriented villages, leads to a dramatic decline in the use of rhyolite in most areas surrounding Blue Ridge sources. One obvious exception to the Late Woodland pattern is the western Piedmont of Maryland. Here the use of rhyolite remains high during Late Woodland times. The general lack of other material options seems to be the major factor influencing this trend. In contrast, the Great Valley on the western side of the Blue Ridge contains a variety of cherts, jaspers, and

other knappable materials (Stewart 1980a:143-160). These cherts and jaspers play a major role in Late Woodland tool manufacturing in the Valley as the use of rhyolite decreases.

The fluctuating use of rhyolite quarry and production sites is very informative in the context of the regional utilization trends just summarized. Paleoindian sites are rare in the Blue Ridge Province and there is no evidence that these early peoples used rhyolite for any of their tool needs. From a practical perspective, rhyolite could have been adapted to Paleoindian lithic technologies. It is possible to flute rhyolite bifaces.

The low biotic resource potentials of early Holocene environments in the Blue Ridge, in comparison with the potentials of environments in adjacent provinces, was probably one reason why rhyolite was ignored and the exploitation of mountainous zones was kept to a minimum. Because of the cooler and wetter climate induced by the Wisconsin glaciation (Carbone 1976:19) it is likely that the broadest mountain and foothill flats, and the broad intermontane valleys of the southern Blue Ridge, supported open meadows or grasslands at this time (Carbone 1976). Maxwell and Davis (1972) theorize that on the Alleghany Plateau of western Maryland, the treeline may have been as low as 1350 feet above sea level, circa 10,500 B.C., with alpine tundra characterizing higher elevations.

The small and narrow valleys that characterize the majority of the intermontane portions of the province would have been extremely wet with few stable floodplains or areas of soil buildup. These areas are presently well watered by innumerable low order streams, springs, and seeps that would have been even more active during Paleoindian times. Forests of the valleys and the more narrow of the upland flats would have been dominated by conifers and probably included spruce, pine, fir, oak, birch, and linden. Although the vegetational mosaics of the time probably supported a very diverse array of fauna, the carrying capacity of many Blue Ridge habitats probably resulted in widely dispersed and small populations of any given species.

In summary, it is not that the Blue Ridge of the early Holocene did not have anything to offer prehistoric peoples; it is simply that the same resources, in addition to other items, could be found in more attractive settings elsewhere. The low population densities postulated for the Paleoindian period also make it unlikely that there was ever a real need to use peripheral types of environments because of stresses placed upon traditionally exploited habitats or resources.

No artifacts diagnostic of the Early Archaic period have yet been found on quarry or production sites, even though we know that rhyolite was being used for the manufacturing of some tools. Analogous situations, where lithic resources are exploited but there is little or no evidence of quarrying, have been documented in the West (Sappington 1984). Early Archaic projectile points appear infrequently at rhyolite processing stations. This implies that the use of rhyolite was not a formalized part of Early Archaic life and that the exploitation of Blue Ridge environments was not a scheduled element of the settlement and subsistence round. This assumption is supported by the relatively low number of Early Archaic sites of any type documented for the Blue Ridge Province in Maryland and Pennsylvania. The quality of early Holocene environments in the Blue Ridge is again probably partially responsible for this pattern.

Climates between 8,000 B.C. and roughly 6,500 B.C. in the region witnessed a warming trend that effectively altered the precipitation/evaporation rates of late glacial times. This would have resulted in the general reduction of open environments and the creation of closed conifer-deciduous forests somewhat similar to those presently found in the Northeast (Carbone 1976:187). These changes would have reduced the nature and range of gregarious fauna and increased the spacing between other large types of game animals. As in late glacial times, the concentration of any given animal specie over space would have been low.

Archeological data also indicate that during the initial phases of the Early Archaic period, prehistoric cultures continued to follow an essentially Paleoindian lifestyle. Thus, adherence to traditions may have also influenced the ways in which Blue Ridge environments were exploited, and ultimately, the degree to which rhyolite was employed in tool manufacturing.

The pattern of rhyolite utilization during the Early Archaic and the extensive distribution of rhyolite artifacts beyond the areas adjacent to sources (see Stewart 1984b:20-24), suggests that all groups had direct access to the material. The far flung distributions of rhyolite artifacts documented for the Early Archaic do not appear to be linked to a regional trade and exchange system, especially since Early Archaic artifacts do not appear at quarry and quarry-related sites. Lithic production systems linked to regional trade and exchange usually show greater regularity in production in terms of what is made, and where it is made (Ericson 1984).

The procurement and production of rhyolite implements during the Middle Archaic period is somewhat

comparable to the Early Archaic situation. Middle Archaic diagnostics appear at rhyolite processing stations but also at a few select quarry workshops. Although the role of rhyolite in prehistoric technologies seems to have changed, the procurement of rhyolite still appears to be a rather sporadic aspect of settlement movements. Middle Archaic projectiles and wasted tools discarded at quarry workshops are generally made from materials other than rhyolite. Middle Archaic groups stayed away from rhyolite sources for so long, that by the time they returned to the quarries, there were few rhyolite tools remaining in their toolkits.

The meager distribution of all types of Middle Archaic sites in the Blue Ridge (Stewart 1983:Figure 12) also indicates that the use of the province is still not a consistent element of settlement and subsistence strategies. Again, the quality of mountain environments may represent an important influence on settlement decisions. Climates of the time can be summarized as a warm and humid trend from roughly 6,500 B.C. to 4,000 B.C., and a warm and dry trend from approximately 4,000 B.C. to 2,000 B.C. (Carbone 1976).

Open types of environments continue to be limited in the Blue Ridge. Mesic deciduous tree species eventually come to dominate area forests with conifers being increasingly limited to well watered ravines and smaller intermontane valleys. By the end of the Middle Archaic period, the area may have witnessed the first deciduous climax forest consisting of oak, hickory, and chestnut. The associated rise in nut-bearing species and related animal communities would have increased the biotic resources that could have been exploited by Middle Archaic groups.

Although Blue Ridge habitats may not have been overly attractive early in the Middle Archaic, by the end of the period, increased exploitation by prehistoric hunters and gatherers would be expected because of increased resource potentials. The degree to which population growth and the broadening of the resource base may have indirectly affected the use of rhyolite cannot be determined. There is currently no evidence to suggest an increase in the use of Blue Ridge environments late in the Middle Archaic period or during the early portions of the Late Archaic period.

The patterns of rhyolite quarry and production activities for much of the Late Archaic, Early Woodland, and Middle Woodland periods are a dramatic contrast to the behaviors of earlier times and those of the Late Woodland period. Artifacts diagnostic of the Late Archaic through Middle Woodland periods are extremely well represented at workshops and processing stations. Only Early and Middle Woodland artifacts have been identified at rhyolite quarries, but the lack of other diagnostic material may simply be a function of the short time groups spent at quarry locations. This apparent intensification in lithic production coincides with the first convincing evidence of trade and exchange in the Middle Atlantic region (Stewart 1984b; Custer 1984).

A range of well defined biface forms and reduction stages, many of which appear as caches on sites in adjacent regions (cf. Geasey 1974), are found at quarry workshops, other workshops, and processing stations. The most well known reduction sequences are those for Susquehanna Broadspears (see Witthoft 1953:Plate 1, Figure 1) and Fox Creek and/or Steubenville knives (Kavanagh 1982; Cresson 1986). Granger (n.d.) has presented an extremely convincing argument indicating that the bifacial reduction strategy for broadspears is in fact the basic sequence for a variety of other Late Archaic and Early Woodland point and knife types. In addition, Silsby (1974) has published a reduction sequence for the Perkiomen type that departs from the forms noted by Witthoft.

From the Late Archaic through much of the Middle Woodland period, rhyolite sources are extensively, intensively, and consistently exploited. The wasted and exhausted tools discarded at quarry and production sites (as toolkits are being replenished) are nearly all made from rhyolite. Return trips to source areas seem to be frequent enough that there is no need for a group to rely heavily on other rock materials available in other parts of their settlement territories.

Non-quarry or non-production related sites are numerous throughout the Blue Ridge; however, most of these seem to be the transient camps of small groups. Major habitation sites or base camps have yet to be identified. Further, although Woodland period sites are well represented, ceramics are dramatically absent on open sites but consistently found in rockshelters. In contrast, ceramic-producing sites and typological sequences are relatively well known for the adjacent Great Valley (Stewart 1982) and Piedmont (Kavanagh 1982). These observations are not merely the result of sampling errors; over 200 sites have been identified in the Maryland Blue Ridge. Surveys were designed to sample topographic and environmental variability as a means of deriving a representative cross section of prehistoric sites (Stewart 1983). A variety of sites are also recorded for the Pennsylvania Blue Ridge with the State Museum and numerous others are known to local collectors.

The patterns noted above underscore the extremely transient nature of settlements in the Blue Ridge, even though available resources and settings could have supported periodic occupations by large groups for extended periods. The oak chestnut forest and open types of environments that would have been in place in the Blue Ridge by 1,000 B.C. would have offered innumerable food resources for prehistoric peoples. By 800 B.C., essentially modern floral and faunal communities are established as are relatively modern climates. Climatic perturbations after 800 B.C. may have involved a cool and dry period from approximately A.D. 200 to A.D. 650, and a hot and dry period circa A.D. 1100 (Carbone 1976). Although these changes may have affected the distribution of various biotic resources, they would not have dramatically altered the overall potentials of Blue Ridge environments. The procurement of rhyolite could have easily been embedded in general settlement and subsistence movements organized to exploit attractive upland settings.

What is implied by the site data and lithic utilization trends is that the Blue Ridge, and specifically areas with rhyolite formations, are visited so frequently that local food resources are reduced to the point of being able to support only transient camps or brief forays by small groups. The most effective strategy for rhyolite-craving groups would have been to grab the rock and run. The rhyolite processing stations at the edge of the Blue Ridge take on added importance in this scenario. People are camping and completing tool production in these settings because the stations are the closest places to the quarries and/or workshops where they can afford to do so.

It seems obvious that rhyolite sources and quarries were considered to be open territory, accessible to all Indian groups who were willing to make the trip. The occurrence of Coastal Plain pottery in rockshelters in the Blue Ridge near rhyolite sources (Stewart, 1983:65; Geasey 1968, 1972) is evidence of this openness. In fact, one motivation for keeping trips into the Blue Ridge brief may have been to avoid potential conflicts with other groups who probably frequented the area. It seems to be no accident that "exotic" Coastal Plain pottery appears only in rockshelters, which could be referred to as the prehistoric "motels" of the area. Rockshelters are sheltered, easily defended places to camp and obvious landmarks. The rockshelters that are situated along streams that drain rhyolite sources are filled with sufficient production debris to be characterized as workshops, and in turn could have served as secondary sources of material. The lack of major habitation sites in the Blue Ridge or near rhyolite sources also indicates that no group ever attempted to control access to the material (Arnold 1985:45).

It is tempting to speculate that part-time, or perhaps seasonal specialists were involved in the procurement and production of rhyolite implements, especially the ubiquitous, oblong bifacial blanks so common on Late Archaic through Middle Woodland sites. The systematic production of regularized tool forms have been viewed by some researchers (Ericson 1984:6) as a craftsman response to anonymous consumers, or consumers with highly variable needs. For this reason, bifacial blanks function well in trade and exchange networks, and rhyolite was certainly traded extensively from Late Archaic through Middle Woodland times (Stewart 1984b).

North American ethnographic data for hunting and gathering societies suggest that at least projectile point manufacturing was accomplished by part time, male specialists (Seeman 1985:16). In this vein, it might be interesting to view the absence of ceramics on open sites in the Blue Ridge as indicating that male-only groups exploited the province and rhyolite sources, assuming that women were the primary manufacturers and caretakers of ceramic vessels. It would have been easy for a small group to provide a number of families with sufficient material during the course of a single trip to the quarries. Based on a series of experimental studies and assemblage analyses for the Great Lakes region, Leudtke (1984) has speculated that approximately 120 pounds of rock would be adequate to satisfy the tool needs of an entire Late Woodland family for one year. This amount of material represents one or two backpack loads for an individual.

During the Late Woodland period, there is a dramatic decline in the use of the regularized quarry and lithic production system evident from Late Archaic through Middle Woodland times. Artifacts diagnostic of the late Woodland period are rarely found at rhyolite quarries or workshops although they do appear at processing stations. The lack of Late Woodland artifacts at quarries and workshops is especially noteworthy since rhyolite is still used in high frequencies by groups from the Piedmont (Kavanagh 1982). The situation is analogous to that of the Early Archaic when lithic procurement occurs with some frequency but leaves little evidence of quarrying. As noted above, the debris left by former occupants of the processing stations could have satisfied some of the expedient material needs of Late Woodland peoples. For most Late Woodland craftsman in the region, there is a renewed emphasis on both bedded and cobble sources of cherts and jaspers.

The number and distribution of all types of Late Woodland sites in the Blue Ridge do not indicate a reduction in the general exploitation of upland environments and resources. Major habitation sites and open sites with ceramics are still rare or absent. This pattern is consistent with the fact that groups from the Piedmont still seem to be consistently procuring rhyolite, even if their neighbors from the Great Valley are not.

Continuing Research

There are extensive collections available from rhyolite quarry and quarry-related sites that should be reanalyzed as part of future research. Most of the quarry and production related localities that have been recorded are known only from preliminary surface collections. Controlled surface collections and excavations would help to sort out the variability noted at many sites and enable the interpretations offered here to be refined. Particularly informative would be detailed studies of rhyolite processing stations. Because these sites represent the final stages of the procurement and production process, they would provide a unique perspective on what should be found on quarry and quarry-related sites. Since a number of the Maryland sites are not as large nor as intensively used as some Pennsylvania localities, investigations in Maryland could serve as a fine tuning exercise for eventually dealing with the complex Pennsylvanian phenomena. Extensive site survey is also needed for the Pennsylvania Blue Ridge and surrounding zones in order to provide a comparative foil for the Maryland data.

In the Maryland Blue Ridge, a number of rockshelters have been identified that have not yet been disturbed by amateur or professional excavations. The close association of exotic ceramics with this site type and the promise of stratified deposits would make detailed investigations of these localities worthwhile.

Although attempts have been made to quantify the regional distribution of rhyolite artifacts (Stewart 1984b; Custer 1984), much more detailed analyses are possible with existing data. Site information for the Maryland Great Valley and Piedmont are detailed enough that synagraphic maps (cf. Earle and Ericson 1977) of rhyolite distributions could be constructed. The large number of known sites and the coverage they provide of the respective provinces make it likely that synagraphic mapping could indicate which quarries and workshops served specific areas in surrounding regions.

The major changes noted in rhyolite procurement and production of tools through time may be tied with changes in social and/or political organization. In order to address this problem, extensive regional and site-specific research will be needed for Piedmont and Great Valley areas of Maryland and Pennsylvania.

Last but not least, experiments in lithic reduction must go hand-in-hand with continued research at quarry and production sites. The efforts of Cresson (1986) and his associates along these lines has been commendable, but like my interpretive venture, they could be improved with data from archeological excavations.

Acknowledgements

Funding and logistical support for the research described above has been provided through the years by: the Maryland Historical Trust; the National Park Service; the Thunderbird Museum and Research Corporation, Front Royal, Virginia; and the Cultural Resource Group of Louis Berger and Associates, East Orange, New Jersey. Of all the people who willingly gave of their time and information, I would especially like to recognize Spencer Geasey, Myersville, Maryland. To all of these organizations and people go my thanks. Errors in fact and fancy are mine to bear. An earlier version of this paper was presented at the 1986 meeting of the Eastern States Archeological Federation in Wilmington, Delaware.

Rferences Cited

Arnold, J. E.
1985 Economic Specialization in Prehistory: Methods of Documenting the Rise of Craft Specialization. In *Lithic Resource Procurement; Proceedings From the Second Conference on Prehistoric Chert Exploitation,* edited by S. Vehik, pp. 37-58. Southern Illinois University at Carbondale, Center for Archaeological Investigations, Occasional Paper No. 4. Carbondale, Illinois.

Beckerman, I.
1981 Seventeen National Register Nominations and Two Reports on Site Boundary Testing for Clemson Island and Fort Loudon. Ms., William Penn Memorial Museum, Harrisburg, Pennsylvania.

Callahan, E.
1979 The Basics of Biface Knapping in the Eastern Fluted Point Tradition: A Manual for Flintknappers and Lithic Analysts. *Archaeology of Eastern North America* 7:1-180.
Carbone, V.A.
1976 *Environment and Prehistory in the Shenandoah Valley.* Ph.D. dissertation, The Catholic University of America, Washington, D.C. University Microfilms, Ann Arbor, Michigan.
Cresson, J.
1986 *Middle Woodland Lithic Technologies: A Chapter in Deciphering a Unique Extractive Process and Production of Rhyolite "Fox Creek" Primary Quarry Bifaces.* Paper presented at the annual meeting of the Eastern States Archeological Federation. Wilmington, Delaware.
Custer, J.
1984 A Contextual Analysis of Woodland I Artifacts Manufactured From Non-Local Materials on the Delmarva Peninsula: Implications for Patterns of Trade and Exchange. In *Prehistoric Lithic Exchange Systems in the Middle Atlantic Region,* edited by J. Custer, pp. 57-83. University of Delaware Center for Archaeological Research, Monograph No. 3. Newark, Delaware.
Deisher, H. K.
1933 South Mountain Indian Quarries. *Pennsylvania Archaeologist* 3(3):6-7, 18-19.
Earle, T. K., and J. E. Ericson (editors)
1977 *Exchange Systems in Prehistory.* Academic Press, New York.
Ericson, J. E.
1984 Toward the Analysis of Lithic Production Systems. In *Prehistoric Quarries and Lithic Production,* edited by J. E. Ericson and B. Purdy, pp. 1-10. Cambridge University Press, New York.
Fauth, J.
1968 Geology of the Caledonia Park Quadrangle Area, South Mountain, Pennsylvania. *Atlas 129a, Fourth Series, Pennsylvania Geological Survey,* Harrisburg.
1977 *Geological Map of the Catoctin Furnace and Blue Ridge Summit Quadrangles, Maryland.* Maryland Geological Survey, Baltimore.
1978 Geology and Mineral Resources of the Iron Springs Area, Adams and Franklin Counties, Pennsylvania. *Atlas 129c, Fourth Series, Pennsylvania Geological Survey,* Harrisburg.
Freedman, J.
1967 Geology of a Portion of the Mount Holly Springs Quadrangle, Adams and Cumberland Counties, Pennsylvania. *Progress Report 169, Fourth Series, Pennsylvania Geological Survey,* Harrisburg.
Gardner, W. M. (editor)
1974 The Flint Run Paleo-Indian Complex: A Preliminary Report, 1971-1973 Seasons. *Occasional Publication No. 1, The Catholic University of America Archaeology Laboratory.* Washington, D.C.
1977 Flint Run Paleo-Indian Complex and Its Implications for Eastern North American Prehistory. *Annals of the New York Academy of Sciences* 288:257-263.
Geasey, S.
1968 The Boyers Mill Rockshelter (Site 18Fr6). *Maryland Archeology* 4(2):25-35.
1972 The Eberhart Rockshelter. *Pennsylvania Archaeologist* 42(3):16-29.
1974 Types of Rhyolite Cache Blades Found in Frederick County, Maryland. *Maryland Archeology* 10(1-2):1-6.
Gramly, R. M.
1980 Prehistoric Industry at the Mt. Jasper Mine, Northern New Hampshire. *Man In the Northeast* 20:1-24.
Granger, J.
n.d. Intrusive Types or Shared Lithic Reduction Sequence: Functional Variation at the Archaic-Woodland Interface in the Lower Great Lakes. Ms., Anthropology Department, University of Louisville, Kentucky.
Hatch, J., and P. Miller
1985 Procurement, Tool Production, and Sourcing Research at the Vera Cruz Jasper Quarry in Pennsylvania. *Journal of Field Archaeology* 12:219-230.
Haynes, J.
1987 *Lithic Diversity in Upland Virginia Sites: Cultural and Natural Embeddedness.* Paper presented at the Third Conference on Upland Archeology in the East. James Madison University, Harrisonburg, Virginia. February 27-29.
Holmes, W. H.
1897 Stone Implements of the Potomac-Chesapeake Tidewater Province. *Bureau of American Ethnology, 15th Annual Report,* pp. 3-152. Washington, D.C.
Johnson, E., T. Mahlstedt, J. Bradley, and V. Talmadge
1984 *Guide to Prehistoric Sites Files and Artifact Classification System.* Massachusetts Historical Commission, Boston.
Kavanagh, M.
1982 Archeological Resources of the Monocacy River Region. *Maryland Geological Survey, Division of Archeology, File Report* 164. Baltimore.

Kent, B.
1970 *Diffusion Spheres and Band Territoriality Among the Archaic Cultures of the Northern Piedmont.* Ph.D. dissertation, The Pennsylvania State University. University Microfilms, Ann Arbor, Michigan.

Luedtke, B.
1984 Lithic Material Demand and Quarry Production. In *Prehistoric Quarries and Lithic Production,* edited by J. Ericson and B. Purdy, pp. 65-76. Cambridge University Press, New York.

Maxwell, J., and M. Davis
1972 Pollen Evidence of Pleistocene and Holocene Vegetation of the Alleghany Plateau, Maryland. *Quaternary Research* 2:513-529.

Peck, D.
1979 Archeological Resources Assessment of the Monocacy River Region, Frederick and Carroll Counties, Maryland: Phase I Inventory, Chronology, and Settlement Pattern. Ms., Maryland Geological Survey, Division of Archeology, Baltimore.

Sappington, R. L.
1984 Procurement Without Quarry Production: Examples From Southwestern Idaho. In *Prehistoric Quarries and Lithic Production,* edited by J. Ericson and B. Purdy, pp. 23-34. Cambridge University Press, New York.

Seeman, M.F.
1985 Craft Specialization and Tool Kit Structure: A Systematic Perspective on the Midcontinental Flint Knapper. In *Lithic Resource Procurement: Proceedings From the Second Conference on Prehistoric Chert Exploitation,* edited by S. Vehik, pp. 7-36. Southern Illinois University at Carbondale, Center for Archaeological Investigations, Occasional Paper No. 4. Carbondale, Illinois.

Silsby, S.
1974 The Turkey Pen Workshop: Analysis of a Perkiomen Lithic Industry. *Quarterly Bulletin of the Archeological Society of Virginia* 28:181-192.

Socolow, A. A.
1980 *Geologic Map of Pennsylvania.* Commonwealth of Pennsylvania, Department of Environmental Resources, Topographic and geologic Survey. Harrisburg.

Stewart, R. M.
1980a *Prehistoric Settlement and Subsistence Patterns and the Testing of Predictive Site Location Models in the Great Valley of Maryland.* Ph.D. dissertation, The Catholic University of America, Washington, D.C. University Microfilms, Ann Arbor, Michigan.
1980b *Environment, Settlement Pattern, and the Prehistoric Use of Rhyolite in the Great Valley of Maryland and Pennsylvania.* Paper presented at the annual meeting of the Middle Atlantic Archeological Conference. Dover, Delaware.
1982 Prehistoric Ceramics of the Great Valley of Maryland. *Archaeology of Eastern North America* 10:69-94.
1983 Prehistoric Settlement Patterns in the Blue Ridge Province of Maryland. In *Upland Archeology in the East, A Symposium,* edited by C. Geier, M. Barber, and G. Tolley, pp. 43-90. USDA, Forest Service Southern Region, Cultural Resources Report No. 2. Roanoke, Virginia.
1984a Archaeologically Significant Characteristics of Maryland and Pennsylvania Metarhyolites. In *Prehistoric Lithic Exchange Systems in the Middle Atlantic Region,* edited by J. Custer, pp. 2-13. University of Delaware Center for Archaeological Research, Monograph No. 3. Newark, Delaware.
1984b South Mountain (Meta) Rhyolite: A Perspective on Prehistoric Trade and Exchange in the Middle Atlantic Region. In *Prehistoric Lithic Exchange Systems in the Middle Atlantic Region,* edited by J. Custer, pp. 14-44. University of Delaware Center for Archaeological Research, Monograph No. 3. Newark, Delaware.

Vehik, S.
1985 Late Prehistoric Settlement Strategy and Exploitation of Florence-A Chert. In *Lithic Resource Procurement: Proceedings From the Second Conference on Prehistoric Chert Exploitation,* edited by S. Vehik, pp. 37-58. Southern Illinois University at Carbondale, Center for Archaeological Investigations, Occasional Paper No. 4. Carbondale, Illinois.

Witthoft, J.
1953 Broad Spearpoints and Transitional Period Cultures. *Pennsylvania Archaeologist* 23(1):4-31.